DEPARTMENT OF PETROLEUM ENGINEERING

Chairman

Dr. Dhafer A. Al Shehri

Faculty

Abdulraheem	Gajbhiye	Mahmoud
Abu-Khamsin	Glatz	Al-Majed
Afnan	Haq	Patil
Awotunde	Al-Hashim	Sultan
Elkatatny	Al-Jawad	Al-Yousef
Fraim	Liao	

The Department of Petroleum Engineering offers graduate studies leading to the degrees of Master of Science, Master of Engineering, and Doctor of Philosophy. The M.S. program was started in 1982 and the Ph.D. program in 1985, and both programs feature multinational student enrollment. The Programs are designed to broaden the student's knowledge in all areas of Petroleum Engineering and to strengthen and deepen the student's understanding in one or more areas of specialty. Particular emphasis is placed on developing the student's research skills and on achieving professional competence in the areas of specialization. The current areas of research and study include Drilling Engineering, Formation Evaluation, Production Engineering, and Reservoir Engineering.

The Department has modern and well-equipped laboratories for teaching and advanced research among which are Drilling Fluid Flow Loop Lab, Drilling Fluid Lab, Quantitative Analysis Lab, Stimulation and Formation Damage Lab, Core Preparation Lab, Rock Mechanics Lab, Enhanced Oil Recovery Lab, Fluid Properties Lab, Rock Properties Lab, Oil Well Cementing Lab, Production Lab, Thin Section Lab, Drilling Simulation Lab, and Well Logging Lab.

Admission Requirements

All applicants for admission to the department must satisfy the general Graduate School admission requirements. In particular, applicants must hold a B.S. degree in petroleum engineering equivalent to KFUPM currenet program, when applying for a master's degree. Applicants for the Ph.D. must hold a master's degree with minimum cumulative GPA of 3.2. Applicants with a degree in other engineering or closely related engineering sciences will, upon admission, be required to take deficiency courses with no graduate credit

MASTER OF SCIENCE IN PETROLEUM ENGINEERING

Degree Requirements

(a) Core Courses (15 credit hours)		Credit Hours
Advanced Petrophysics	PETE 525	3
Advanced Reservoir Engineering	PETE 548	3
Mathematical Methods in Petroleum Engineering	PETE 560	3
Seminar	PETE 599	0
Thesis	PETE 610	6

(b) Elective Courses (15 credit hours)		Credit Hours
Three PETE Courses	PETE 5xx	9
Two Technical Elective Courses	XXX 5xx	6

Degree Plan

COURSE	TITLE	LT	LB	CR	COURSE	TITLE	LT	LB	CR
First Year									
PETE 525	Advanced Petrophysics	3	0	3	PETE 548	Advanced Reservoir Eng.	3	0	3
PETE 560	Mathematical Methods in Petroleum Eng.	3	0	3	PETE 5xx	PETE Elective II	3	0	3
PETE 5xx	PETE Elective I	3	0	3	PETE 599	Seminar	1	0	0
					PETE 5xx	PETE Elective III	3	0	3
		9	**0**	**9**			**10**	**0**	**9**
Second Year									
XXX 5xx	Technical Elective I	3	0	3	PETE 610	Thesis	0	0	6
XXX 5xx	Technical Elective II	3	0	3					
PETE 610	Thesis	0	0	IP					
		6	**0**	**6**			**0**	**0**	**6**
Total credit hours required in Degree Program : 30									

MASTER OF ENGINEERING IN PETROLEUM ENGINEERING

Degree Requirements

(a) Core Courses (12 credit hours)		Credit Hours
Advanced Petrophysics	PETE 525	3
Advanced Reservoir Engineering	PETE 548	3
Mathematical Methods in Petroleum Eng.	PETE 560	3
Seminar	PETE 599	0
Professional Engineering Project	PETE 600	3

(b) Elective Courses (21 credit hours)		Credit Hours
Four PETE Courses	PETE 5xx	12
Two Technical Elective Courses	XXX 5xx	6
One Free Non-Technical Business Oriented Elective Course (must be from Business or EM majors)	XXX 5xx	3

Degree Plan

COURSE	TITLE	LT	LB	CR	COURSE	TITLE	LT	LB	CR
First Year									
PETE 525	Advanced Petrophysics	3	0	3	PETE 548	Advanced Reservoir Eng.	3	0	3
PETE 560	Mathematical Methods in Petroleum Eng.	3	0	3	PETE 599	Seminar	1	0	0
					PETE 5xx	PETE Elective I	3	0	3
		6	**0**	**6**			**7**	**0**	**6**
Second Year									
PETE 5xx	PETE Elective II	3	0	3	PETE 5xx	PETE Elective IV	3	0	3
PETE 5xx	PETE Elective III	3	0	3	XXX 5xx	Technical Elective I	3	0	3
		6	**0**	**6**			**6**	**0**	**6**
Third Year									
PETE 600	Professional Engineering Project	0	0	3	XXX 5xx	Technical Elective II	3	0	3
XXX 5xx	Free Non-Technical Elective	3	0	3					
		3	**0**	**6**			**3**	**0**	**3**
Total credit hours required in Degree Program : 33									

- The order of taking the courses can be different from above, but students must take the core courses before electives.

PHD IN PETROLEUM ENGINEERING

Degree Requirements

(a) Core Courses (18 credit hours)		Credit Hours
Advanced Fluid Properties and Thermodynamics	PETE 611	3
Fluid Flow in Porous Media	PETE 645	3
Seminar	PETE 699	0
PhD Pre-Dissertation	PETE 711	3
PhD Dissertation	PETE 712	9

(b) Elective Courses (24 credit hours)		Credit Hours
One PETE Course	PETE 5xx	3
Four PETE Courses * , **	PETE 6xx	12
Two Technical Elective Courses	XXX 5xx	6
One Free Elective Course	XXX 5xx	3

Degree Plan

COURSE	TITLE	LT	LB	CR	COURSE	TITLE	LT	LB	CR
First Year									
PETE 645	Fluid Flow in Porous Media	3	0	3	PETE 5xx	PETE Elective II	3	0	3
PETE 611	Adv. Fluid Properties and Thermodynamics	3	0	3	PETE 6xx	PETE Elective III	3	0	3
PETE 6xx	PETE Elective I*	3	0	3	PETE 6xx	PETE Elective IV**	3	0	3
		9	**0**	**9**			**9**	**0**	**9**
Second Year									
PETE 6xx	PETE Elective V	3	0	3	XXX 5xx	Free Elective	3	0	3
XXX 5xx	Technical Elective I	3	0	3	PETE 711	PhD Pre-Dissertation	0	0	3
XXX 5xx	Technical Elective II	3	0	3					
PETE 699	Seminar	1	0	0					
		10	**0**	**9**			**3**	**0**	**6**
Third Year									
PETE 712	PhD Dissertation	0	0	IP	PETE 712	PhD Dissertation	0	0	9
		0	**0**	**0**			**0**	**0**	**9**
Total credit hours required in Degree Program : 42									

* Could be PETE 701 (Directed Reaserch I)
** Could be PETE 702 (Directed Reaserch II)

- The order of taking the courses can be different from above, but students must take the core courses before electives.

PETROLEUM ENGINEERING

PETE 513 Advanced Drilling Fluids (3-0-3)
Introduction in-depth coverage of drilling fluids chemistry, rheology and rig hydraulics. Classical and evolving drilling fluid systems, clay chemistry, shale stabilization, drilling fluid additives and contaminants. This course provides an overview and addresses the various problems and solutions related to drilling fluids.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 514 Complex Fluids and Rheology (3-0-3)
Introduction to complex fluids, classical solids and liquids; basic forces Newtonian and Non-Newtonian fluids mechanics; standard flows and rheology. Provide an overview and understanding of constitutive modeling; polymers and polymer gels; suspensions; foams; emulsion; blends; liquids crystals; surfactant solutions; experimental and measurements.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 517 Fundamentals of Oilfield Chemistry (3-0-3)
Overview of oilfield chemicals used in drilling, completion, workover, stimulation, water treatments and shutoff. Design of fluids needed to stimulate the well to avoid several aspects of formation damage. Oilfield scales such as organic and inorganic scales. Scale inhibition techniques such as thermodynamic and kinetic methods. Scale prediction and quantification models. Scale removal treatment design. Gas hydrate formation, hydrate prevention (kinetic and thermodynamic methods), hydrate removal, gas hydrate prediction models.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 524 Advanced Well Logging (3-0-3)
Fundamentals of nuclear logging such as gamma ray, and neutron, theory, interactions with the rocks. Advanced logging theory and techniques such as reservoir saturation tool and lithology determination from neutron interactions. Advanced calipers, oriented calipers, multi arms calipers. Advanced and conventional resistivity logs such as image logs, array tools. Porosity logs such as density, neutron, acoustics, and NMR. Advanced acoustic measurements such as acoustic imaging. The course provides the student with the basic and advanced skills and techniques needed to interpret modern well log for identification and evaluation of potential hydrocarbon zones from a standard suite of logs. Commercial softwares will be used for log interpretation.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 525 Advanced Petrophysics (3-0-3)
Properties of reservoir rocks, lithology, porosity and permeability measurement methods, surface and interfacial tension, capillary pressure characteristics, rock and reservoir fluids interactions and their effects on wettability, relative permeability measurement techniques, electrical resistivity and resistivity models.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 527 Advanced Drilling Engineering (3-0-3)
This course provides a thorough understanding of the drilling operations and the

various factors affecting them. This course is designed to give the students thorough understanding of hoisting and drill string design, drilling fluids, hydraulics, pore and fracture pressure prediction, casing seating depth and casing grade design, well cementing, well control and monitoring system, and well drilling course analysis.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 528 Underbalanced and Managed Pressure Drilling (3-0-3)
This course provides a deep understating and applications of underbalanced and managed pressure drilling (UBD & MPD). Topics covered are types of drilling fluids used (air, mist foam, etc.), flow drilling, mud cap drilling and hydraulics calculations, surface equipment for UBD, completion of UBD drilling wells. In addition to the basic principles of MBP, problems encountered in MPD, well control, equipment used in MPD and MPD candidate selection are addressed.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 529 Formation Evaluation (3-0-3)
Introduction to advanced concepts in formation evaluation for the estimation of static and dynamic petrophysical properties of rocks from well logs, core data, and geological information. Petrophysical well logging, mud logging, advanced logging tools and interpretation is addressed. Software and computer applications are emphasized.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 532 Well Performance (3-0-3)
Introduction to fluid flow dynamics in wells, the inflow performance relationships and the horizontal, vertical and inclined multiphase flow correlations and mechanistic models, composite model of fluid flow through the wellbore. Special IPR models such as Gas condensate IPR using transient well test and building of multilayer well flow performance model is covered. Productivity enhancement by stimulation, work over, sand management, corrosion control, and artificial lifting will be introduced. Students will also be exposed to introduction to risk and economic analysis of production system. The course emphasizes computer applications through the utilization of student developed and commercially available software.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 533 Surface Production Facilities (3-0-3)
Introduction to comprehensive understanding of oil and gas processing techniques along with knowledge of physical and thermodynamic property correlations to meet fluid specifications. Detailed theory, design, sizing and analysis surface production equipment: PVT analysis and optimizing of separator conditions, two-phase oil and gas separator, three-phase oil-water-gas separator, oil processing and conditioning, gas processing and conditioning, and water treatment facilities.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 543 Advanced Waterflooding (3-0-3)
Thorough understanding of the physics, mechanics and performance of water flooding. Various performance-prediction methods are discussed and compared. Emphasis is placed on the choice of the proper method utilizing available reservoir data. A term project requires the student to design a water flood that meets imposed restrictions and satisfies performance requirements.

Prerequisite: Graduate Standing or Consent of Instructor

PETE 544 Natural Gas Engineering (3-0-3)
Understanding of techniques needed to estimate gas reserves for normally and abnormally pressured gas reservoirs, water drive gas reservoirs, and gas condensate reservoirs. Production forecasting and decline curve analysis. Productivity enhancement through gas cycling. Fundamental gas flow equation and its solution in terms of pressure, pressure squared, and pseudo function. Gas well tests design and analysis. Analysis of hydraulically fractured gas well test. Gas field development including reservoir deliverability, total system analysis (inflow/outflow performance of gas wells), and optimum development patterns.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 546 Well Test Analysis (3-0-3)
The course is designed to teach petroleum engineering students the basic and fundamental theory and practices for pressure transient well test, and well test interpretation techniques for different systems.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 548 Advanced Reservoir Engineering (3-0-3)
Advanced knowledge of reservoir engineering as well as the technical responsibilities of a reservoir engineer starting from the appraisal to development. Immiscible and miscible displacement processes in porous media, overall reservoir performance, graphical and analytical decline curve analysis, dynamic material balance, unconventional gas reservoirs, diffusivity equation and pressure transient in oil and gas reservoirs, and the appraisal of oil and gas fields are addressed.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 549 Advanced Reservoir Simulation I (3-0-3)
Numerical solution of fluid flow equations from single phase multiphase flow problems. The main objective of the course is the multi-dimensional simulation of single and multiphase flow problems. Handling external and internal boundary conditions. Well modeling including the presence of skin and wellbore storage effects. Black-oil models. Well modeling and multi-block well completions.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 551 Petroleum Economic Analysis (3-0-3)
Principles of economics as applied to the petroleum industry. Economic concepts such as time value of money, profitability measures, cash flow, depreciation, cost estimation, risk and uncertainty analysis. Applications for screening and evaluation of small and major projects are emphasized.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 552 Advanced Reservoir Management (2-1-3)
Hydrocarbon reservoir management: Geology, geophysics, and petroleum engineering; field operating and development plan from primary depletion to abandonment; optimizing profitability while enhancing hydrocarbon recovery; reservoir management process: Planning, Implementing, Monitoring, and Evaluating; Advanced Topics:

Value of Information versus engineering estimation, Streamline Simulation for pattern monitoring, and Reservoir Engineering Optimization Techniques; Production optimization, Project economic analysis, Case studies.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 560 Mathematical Methods in Petroleum Engineering (3-0-3)
Topics in Applied Mathematics that are relevant to Petroleum Engineering. The main areas considered are special functions, integral transforms and linear algebra. Applications to solving flow problems is achieved through assignments and project.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 590 Special Topics in Petroleum Engineering I (3-0-3)
Advanced topics are selected from the broad area of Petroleum Engineering. The contents of the course are given in detail one semester in advance of that in which it is to be offered.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 591 Special Topics in Petroleum Engineering II (3-0-3)
Advanced topics are selected from the broad area of Petroleum Engineering. The contents of the course are given in detail one semester in advance of that in which it is to be offered.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 592 Special Topics in Petroleum Engineering III (3-0-3)
Advanced topics are selected from the broad area of Petroleum Engineering. The contents of the course are given in detail one semester in advance of that in which it is to be offered.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 593 Special Topics in Petroleum Engineering IV (3-0-3)
Advanced topics are selected from the broad area of Petroleum Engineering. The contents of the course are given in detail one semester in advance of that in which it is to be offered.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 594 Special Topics in Petroleum Engineering V (3-0-3)
Advanced topics are selected from the broad area of Petroleum Engineering. The contents of the course are given in detail one semester in advance of that in which it is to be offered.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 595 Special Topics in Petroleum Engineering VI (3-0-3)
Advanced topics are selected from the broad area of Petroleum Engineering. The contents of the course are given in detail one semester in advance of that in which it is to be offered.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 599 Seminar (1-0-0)
Graduate students working towards the M.S. degree are required to attend the seminars given by faculty, visiting scholars, and fellow graduate students. Additionally, each

student must present at least one seminar on a timely research topic. Among other things, this course is designed to give the student an overview of research in the department, and a familiarity with the research methodology, journals and professional societies in his discipline. Graded on a Pass or Fail basis.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 600 Professional Engineering Project (0-0-3)
The student has to apply knowledge gained in course work to conduct research and perform independent study to prepare a report. This report will be presented and examined by a faculty committee.
Corequisite: PETE 599

PETE 606 Independent Research (3-0-3)
This course is intended to allow M.S. students conduct research-based independent study. The faculty offering the course should submit a research plan to be approved by the PETE Graduate Program Committee. The student is expected to deliver a public seminar and a written report on his research. To select adequate subject, prior arrangement with the instructor is required. The course is graded on a Pass or Fail basis.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 610 M.S. Thesis (0-0-6)
Involves individual study by students in the field of petroleum engineering. The work should be original and the concept, data and the conclusions should contribute new knowledge to the field of petroleum engineering. The quality of the work should reflect the student's proficiency in research and creative thinking. Following preliminary studies and a literature survey on the thesis subject, each student will present his proposed thesis subject orally and also submit a written proposal to the Deanship of Graduate Studies for approval. On satisfactory completion of his thesis work, the student is required to make a formal defense of the thesis.
Corequisite: PETE 599

PETE 611 Advanced Fluid Properties and Thermodynamics (3-0-3)
This advanced course in fluid properties covers topics related to PVT of hydrocarbons, which include: the fundamentals of thermodynamics; petroleum fluid systems; characterization of reservoir fluids; PVT tests and correlations; phase and chemical equilibria; phase behavior and thermo-physical properties; Equations of State and associated calculations, advanced modeling techniques of reservoir fluids; Interfacial tension in multi-phase systems and applications in oil and gas industry.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 614 Colloid, Interfaces and Electrokinetics (3-0-3)
Colloids, interfaces and electrokinetics covers surface tension and surface free energy; surface films on liquid substrates, capillarity, gecko effect, electrical aspects of surface chemistry; surface of solids; solid-liquid interface, stability of dispersions; stabilization of suspensions, contact angle, emulsions, foams and aerosols; wetting of surfaces by liquids, lotus effect, flotation, aggregation and flocculation, detergency; surfactants; self-assembly, micelles and vesicles, friction, lubrication and adhesion; adsorption,

characterization of colloidal particles, etc. Applications of colloid and surface science in drilling; production and Enhanced Oil Recovery will be covered.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 620 Advanced Rock Mechanics (3-0-3)
Detailed coverage of the fundamentals of rock mechanics including the theories of elasticity, and failure mechanics, borehole stresses and acoustic wave propagation. Laboratory and field methods of acquiring rock mechanics data relevant to field applications are discussed. The course concludes with discussions of the application of rock mechanics in studying borehole stability, sand control, reservoir compaction and fracturing.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 622 Horizontal and Directional Drilling (3-0-3)
Introduction to horizontal and directional drilling. Basic terminologies types of directional drilling, horizontal well planning, long, medium, and short radius wells, directional drilling tools, drilling in sliding and rotating modes, toque, drag, bending, and buckling calculations for drill string, well survey, current and future trend in directional drilling, and casing, cementing, and completion of deviated well.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 624 Advanced Well Control (3-0-3)
Basic fundamentals of well control during drilling and tripping in land and offshore wells. Topics include abnormal pressure detection, fracture gradient determination, casing setting depth selection, well control procedure while drilling and tripping, special conditions and problems in well control operation, well control equipment, well control while drilling from a floating rig, relief well design, underground blow out, and case study.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 635 Well Stimulation (3-0-3)
Integration of important aspects of near wellbore development and management: (i) formation damage diagnosis and modeling; (ii) matrix acidizing; and (iii) hydraulic and acid fracturing of conventional and unconventional reservoirs. State-of-the art methodologies and practices will be introduced. The emphasis is on understanding the sources of formation damage and designing the appropriate stimulation treatment accordingly. Special range of topics including: stimulation fluid chemistry, tight gas reservoirs are addressed.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 637 Applied Hydraulic Fracturing (3-0-3)
Fundamental knowledge and tools needed to design and analyze hydraulic and acid fracturing jobs. An overview of the fundamental of rock mechanics and its application to hydraulic fracturing. Data requirements and various elements of massive hydraulic fracturing treatment design. Design of fracture treatment using analytical tools and commercial simulators. Term project to design a fracturing treatment and evaluate the post treatment performance of the well is required.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 638 Artificial Lift (3-0-3)

In-depth look at artificial lift is provided. Overview of various artificial lift solution and related production optimization concept. Theory, design and analysis of topics to include: reservoir and well performance, gas lift, electric submersible pump, sucker rod pump, progressive cavity pump, plunger lift, hydraulic pump, selection and comparison of artificial lift methods and recent advancement in artificial lift technology.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 641 Geostatistical Reservoir Characterization (3-0-3)
Topics required for analysis of spatial variables. Topics include introductory concepts in Geostatistics, Statistical Analysis and Linear Estimation theory, Geostatistical Estimation, Geostatistical Simulation and Multipoint Simulation.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 642 Advanced Well Test Analysis (3-0-3)
Advanced concepts in well test analysis are covered. The course introduces the students to the mathematical concepts of convolution and deconvolution for analysis of multi-rate tests. Other topics covered include transient pressure solution in complex wells and complex reservoirs, and parameter estimation in will test analysis.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 643 Molecular Simulation for Engineering Applications (3-0-3)
Introduction to different tools of the computational chemistry and their application to Petroleum Engineering problems. Introduction to crucial equations and the physical meaning of each equation. Molecular Mechanics; Geometry optimization; Quantum mechanics; DFT; Molecular dynamics simulation; free energy calculations will be introduced. Several hands on tutorials on each topic to ensure that the students understand concepts covered.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 645 Fluid Flow in Porous Media (3-0-3)
Advanced concepts in flow of fluids through porous media are introduced. The course introduces the students to mathematical concepts that are indispensable in any advanced course on fluid flow. Other topics covered include single-phase flow, two-phase flow, transport of contaminants in porous media, flow of fluids in free-flow regions, modeling two-dimensional flows with streamlines; and non-isothermal flow of fluids in porous media.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 646 Advanced Reservoir Simulation II (3-0-3)
Advanced concepts in Reservoir Simulation. Topics covered include Compositional Simulation, Non-isothermal Flow Simulation, Modeling of Horizontal and Deviated Wells in Reservoir Simulator, Streamline Simulation and Reservoir Model Upscaling.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 647 Pore Scale Modeling (3-0-3)
Division of flow regimes from molecular scale to field scale and introduction to the corresponding theories and numerical methods for each regime; Lattice Boltzmann method (LBM); Pore-scale simulations of single phase and two-phase flows; Permeability calculations and its dependence on the contact angle and interfacial tension coefficient (IFT); Fortran code design based on LBM and its application on

HPC.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 648 Enhanced Oil Recovery I (3-0-3)
The practical and design aspects of enhanced oil recovery (EOR) methods as practiced in post-waterflood with oil reservoirs. Design, screening criteria, and field applications of Chemical (polymer, surfactant, ASP, alkaline, and low salinity water) injection EOR methods, and Microbial enhanced hydrocarbon recovery.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 650 Enhanced Oil Recovery II (3-0-3)
The practical and design aspects of enhanced oil recovery (EOR) methods as practiced in post-waterflood with oil reservoirs. Design, screening criteria, and field applications of Gas (LPG, CO2, Foam and WAG), and Thermal (steam, SAGD and in-situ combustion) EOR techniques.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 655 Artificial Intelligence in Petroleum Engineering (3-0-3)
Theoretical and programming aspects of artificial intelligence techniques with applications to the various areas of petroleum engineering. The basics of Artificial Neural Networks, Fuzzy Logic and Genetic Programming are addressed with their applications in reservoir characterization, reservoir engineering, drilling engineering and production operations. The students are expected to do individual projects utilizing commercial software to solve real world problems.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 656 Uncertainty Quantification in Engineering (3-0-3)
Introduction to fundamentals of Uncertainty Quantification and its application to stochastic analysis of heterogeneous subsurface flow and transport models. The objective of the course is to provide students with uncertainty quantification methods that can be used either to predict the uncertainty of production from the statistical information of the subsurface property, or to estimate the subsurface property from dynamic production data. Topics including introduction to concepts in forward and inverse modeling, principle component analysis, random sampling methods, polynomial surrogate methods, stochastic collocation and sparse grids, Bayesian inference, Kalman filter, Markov chain Monte Carlo method are covered.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 699 Seminar (1-0-0)
Attendance of departmental seminars given by faculty, graduate students and visiting scholars. Graduate students are expected to contribute seminars on literature searches of topics of current interest to Petroleum Engineering. Graded on a Pass or Fail basis.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 701 Directed Research I (3-0-3)
This course is intended to allow students conduct research in advanced problems in their Ph.D. area of specialization. Among other things, the course is designed to give the students an overview of research in CPG, and a familiarity with research methodology, journals and professional societies in his discipline. At the end of the course, the student is expected to deliver a public seminar to present his work and

findings. To select adequate subject, prior arrangement with the instructor is required. The course is graded on a Pass or Fail basis.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 702 Directed Research II (3-0-3)
This course is intended to allow students conduct research in advanced problems in their Ph.D. area of specialization. Among other things, the course is designed to give the students an overview of research in CPG, and a familiarity with research methodology, journals and professional societies in his discipline. At the end of the course, the student is expected to deliver a public seminar to present his work and findings. To select adequate subject, prior arrangement with the instructor is required. The course is graded on a Pass or Fail basis.
Prerequisite: Graduate Standing or Consent of Instructor

PETE 711 Ph.D. Pre-Dissertation (0-0-3)
This course enables the student to submit his Ph.D. Dissertation Proposal and defends it in public. The student passes the course if the Ph.D. Dissertation committee accepts the submitted dissertation proposal report and upon successfully passing the Dissertation proposal public defense. The course grade can be NP, NF or IP.
Prerequisite: Ph.D. Candidacy, PETE 699

PETE 712 Ph.D. Dissertation (0-0-9)
This course enables the student to work on his Ph.D. Dissertation as per the submitted dissertation proposal, submit its final report and defend it in public. The student passes this course if the PhD Dissertation committee accepts the submitted final dissertation report and upon successfully passing the Dissertation public defense. The course grade can be NP, NF or IP.
Prerequisite: PETE 711